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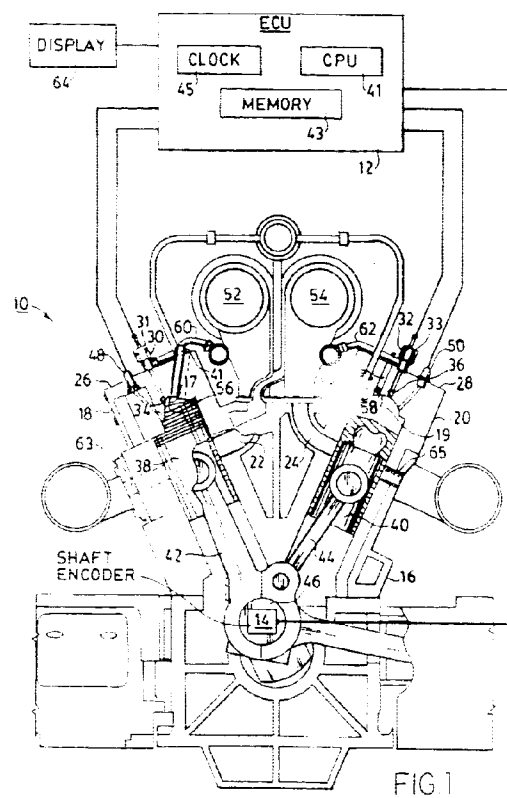
(71) Applicant: **DRESSER-RAND COMPANY**
Corning, New York 14830 (US)

(72) Inventor: **Wertheimer, Harry P.**
New York 14870 (US)

(74) Representative: **Harvey, David Gareth et al**
Graham Watt & Co.
Riverhead
Sevenoaks Kent TN13 2BN (GB)

(54) Injection timing and power balancing control for gaseous fuel engines

(57) Apparatus and method for controlling injection timing and power balancing in a gaseous fuel engine (10) with an electronic control unit (12) and a shaft encoder (14) is disclosed. The engine (10) includes an engine block (16) having at least one cylinder (18) with an exhaust port (22) and a cylinder head (26). A fuel injector (30) and a spark plug (41) is seated in the cylinder head and the injector has a valve (34) which separates the fuel in the injector from the cylinder. A piston (38) reciprocates in each cylinder (18) and is attached to a connecting rod (42) which connects to a crankshaft (46) which converts the motion of the piston to rotary motion. The shaft encoder (14) is connected to the crankshaft (46) and monitors its revolutions, and the electronic control unit (12) is coupled to the shaft encoder (14) and to the fuel injector (30). The method includes several steps: first, a working injection time setting the time for the or each fuel injector to start an injection of fuel into the cylinder is retarded to an initial injection time; second, the speed of the crankshaft is measured and compared against a first preset limit. The working injection time is advanced at a predetermined rate, if the monitored speed exceeds the first preset limit, and when the working injection time is advanced to be equal to or less than a programmed function of speed, the working injection time is set to the injection time calculated from the programmed speed function. The method may also involve establishing a working pulse width for the or each cylinder, measuring an index of the power output in said cylinder, calculating a balancing factor in response to the measured index, and adjusting the working pulse width in response to the balance factor for the cylinder.



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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 33 35 637 A (FUJI HEAVY IND LTD) * abstract * * page 3, line 14 - line 17 * * page 4, line 16 - line 36 * * figures 1-5 * ---	1-5,9-13	F02D41/34
A	US 5 183 013 A (ITO HIDEAKI ET AL) * abstract * * figures 3,7,8,10,11 * * column 1, line 60 - column 2, line 39 * * column 6, line 18 - line 44 * * column 7, line 62 - column 8, line 15 * ---	1-5,9-13	
A	US 4 807 572 A (SCHLUNKE CHRISTOPHER K) * abstract * * figures 1,3,4 * * column 1, line 1 - line 17 * * column 6, line 41 - column 7, line 50 * ---	1-5,9-13	
A	US 4 667 634 A (MATSUMURA TOSHIMI ET AL) * abstract * * figures 3-8 * * column 2, line 20 - line 46 * ---	6-8, 14-16	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F02D
L	FR 2 627 809 A (ORBITAL ENG PTY) * abstract * * page 2, line 25 - line 29 * * page 4, line 27 - page 5, line 28 * * page 6, line 17 - line 24 * * page 7, line 8 - line 11 * * page 11, line 11 - page 13, line 14 * * figure 3 * -----	1-5,9-13	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 March 1998	Examiner Trotureau, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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